1,3-Butadiene (BD) as a biomarker of exposure

- Phase distribution in smoke:
  Gas phase: concentration in MS between 16 and 77 µg/cigarette (Brunnemann et al., 1990; Vickroy, 1976)
  In sidestream smoke: 205 to 361 µg/cigarette (Brunnemann et al., 1990); 400 µg/cigarette (IARC, 1999 citing IARC, 1992, which in turn cited Lofroth et al, 1989)

- Occurrence in ETS:
  Around 1 µg/m3 or 0.00045 ppm (Heavner et al., 1996; Brunnemann et al., 1990)
  In smoky indoor environments: 10-20 µg/m3 (IARC, 1992)

- Known sources other than cigarette smoke:
  Automobile exhaust, foods packaged in 1,3-butadiene rubber-based plastic containers (e.g., olive oil, yogurt), combustion of wood, industrial release associated with its manufacture, transport, storage, and use (HSDB, 2000)

- Metabolism:
  BD is metabolized to the monoepoxide, 1,2-epoxy-3-butene (butadiene monoepoxide, BMO) and then oxidized to its diepoxide, 1,2:3,4-diepoxybutane (BDO2) (Csanady et al., 1992; Thornton-Manning et al., 1995). Further metabolism of BDO2 and possibly BMO yields 3,4-epoxy-1,2-butanediol (EBD). The reactive metabolite BMO forms 1- and 2-hydroxy-3-butenyl valine adducts in hemoglobin (MHBVal). Urine metabolites derived from conjugation of BMO with glutathione (Himmelstein et al., 1997) are mixture of monohydroxy-3-butenyl mercapturic acid (MHBMA) and 1,2-dihydroxybutyl mercapturic acid (DHBMA).

- Literature:

  Hemoglobin adduct (MHBVal) in blood:
  - no difference between smokers and nonsmokers (<2 pmol/g Hb, Van Sittert and Van Vliet, 1994);
  - slightly lower in smokers (0.08 pmol/g Hb) than in nonsmokers (0.33 pmol/g Hb) (Van Sittert et al., 2000);
  - smokers (approx. 0.04-0.13 pmol/g Hb) showed somewhat higher value than nonsmokers (approx. 0.02-0.05 pmol/g Hb) (Osterman-Golkar et al., 1996).

Source: https://www.industrydocuments.ucsf.edu/docs/fkcj0001

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